Electrical Transport in Solids of Colloidal Nanoparticles and Applications to Infrared Photodetection

Philippe Guyot-Sionnest
The University of Chicago

Granular conducting systems were extensively studied from the 1960s to the 1980s, as physical realizations of disordered semiconductor, superconducting or metallic systems. Nowadays, many proposed applications of colloidal nanoparticles involve electrical transport, and understanding the physics of transport is of current and practical interest. With monodispersed Pb nanoparticles, we measured the insulating to superconducting transitions as the coupling between the particles increased. With CdSe semiconductor quantum dots, the systems studied displayed the variable range hopping models developed decades earlier by Efros, Shklovskii and Mott. We also study the 1/f electrical noise in monodispersed nanoparticle solids, Au, CdSe, which is another difficult but practical question, and particularly relevant for infrared detection applications with HgTe quantum dots.